

Appl. No. 10/607,615
Amendment dated March 18, 2005
Reply to Office Action of December 17, 2004

REMARKS

Claims 1, 115 – 153, 155 – 209 and 211 – 228 are pending in the application. Claims 209 – 228 have been allowed. Claims 139, 165, 169 – 171, 174 – 183, 190, 192 195 – 197 and 200 – 208 have been objected to. Claims 1, 115 – 138, 140 – 164, 166 – 168, 172, 173, 184 – 189, 191, 193, 194, 198 and 199 have been rejected. Claims 1, 115, 140, 164, 166, 167, 193 and 212 have been amended. Claims 139 and 165, which were objected to, have been canceled, with the limitations recited in each claim having been added to independent claims 115 and 164, respectively. Allowed claim 212 has been amended to correct an antecedent basis problem noted by Applicants' representative. Claims 1, 115 – 138, 140 – 153, 155 – 164, 166 – 209 and 211 – 228 remain in the application and are presented for reconsideration.

The Examiner rejected claims 115, 116, 118, 125, 128, 131, 164, 167, 173, 184, 189, and 191 under 35 USC § 102(b) as being anticipated by *Chu, et al.* (U.S. 5,269,372). The rejection of these claims is respectfully traversed.

Claim 115 has been amended to recite the limitation of claim 139. The Examiner objected to claim 139, but indicated that it would be allowable if amended to include the limitations of the base claim and any intervening claims. Since claim 139 depends directly from 115, its limitation has been added to claim 115. Claim 139 has been canceled as a result. Therefore, claim 115 should be allowable over *Chu, et al.* Claims 116, 118, 125, 128, and 131 depend, either directly or indirectly, from amended claim 115. Therefore, these claims should be allowable as well.

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Claim 164 has been amended to incorporate the limitation of "objected to" claim 165. Therefore, claim 164 should be allowable over *Chu, et al.* Claim 165 has been canceled by this response.

The rejection of claim 167 as being anticipated by *Chu, et al.* appears to be improper. *Chu, et al.* does not teach a high flow rate fluid pump as recited in the claim. *Chu, et al.* also fails to disclose a heat exchanger configured to provide flow of the fluid therethrough and the transfer of thermal energy out of the fluid as recited in the claim. Furthermore, *Chu, et al.* fails to teach that a substrate, heat exchanger, and fluid pump are configured to operate together to create a closed loop fluid flow. Therefore, claim 167 is not anticipated by *Chu, et al.* Claims 173, 184, 189 and 191 depend, either directly or indirectly from claim 167, and therefore are not anticipated by *Chu, et al.* for at least the same reasons. However, to advance prosecution of the present application, claim 167 has been amended to recite the same limitation added to claims 115 and 164.

The Examiner rejected claims 117, 120 – 124, 126, 127, 130, 132 – 138, 166, 172, and 185 – 188 under 35 USC § 103(a) as being unpatentable over *Chu, et al.* (U.S. 5,269,372) in view of *Arana, et al.* (U.S. 2003/0027022). This rejection is respectfully traversed.

Claims 117, 120 – 124, 126 – 127, 130, and 132 – 138 depend, either directly or indirectly, from amended claim 115 and are allowable for at least the same reasons that claim 115 is allowable. Similarly, claims 172 and 185 – 188 depend, either directly or indirectly, from independent claim 167 and are allowable for at least the same reasons that claim 167 is allowable.

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The limitation of claim 165 has also been added to claim 166. Therefore, claim 166 should be allowable as well.

The Examiner rejected claims 129 and 168 under 35 USC § 103(a) as being unpatentable over *Chu, et al.* (U.S. 5,269,372) in view of *Arana, et al.* (U.S. 2003/0027022) as applied to the above claims and further in view of the China Reference (97212126.9). The rejection of these claims is respectfully traversed.

The Examiner stated that the invention of *Chu, et al.* as modified by *Arana, et al.* discloses all the claim limitations, except for a high flow rate electroosmotic pump, wherein the pump is disposed between the heat exchanger in the substrate. The Examiner stated that the China reference teaches the use of a high flow rate electroosmotic pump. The Examiner concluded that, given the teachings of the China Reference, it would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the cooling system of *Chu, et al.* with the high flow rate electroosmotic pump, wherein the pump is disposed between a heat exchanger and a substrate.

Claim 129 depends from amended claim 115 and is allowable for at least the same reasons that claim 115 is allowable. Claim 168 depends from claim 167 and is allowable for at least the same reasons that claim 167 is allowable.

With regard to the teachings of *Arana, et al.*, Applicants incorporate by reference the remarks concerning the teachings of this published patent application in the amendment response filed October 4, 2004. Additionally, *Arana, et al.* teaches at page 5, paragraph 55, that "actuators may also be integrated into the micro-machined device such as, for example, resistive heaters,

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electrodes for electrophoretic or electroosmotic flow, electrodes for electrochemistry, valves, pumps, and any various other actuators." In this teaching *Arana, et al.* refers to an electroosmotic pump as an integrated part of the micro-machined device. What this means is that any type of electroosmotic pump taught by *Arana, et al.* would be used as an actuator, capable of pumping microliters per minute, not milliliters per minute, and could certainly not be used for cooling purposes. Applicants incorporate by reference the remarks presented below concerning the China Reference. Therefore, claims 129 and 168 are allowable for this additional reason.

The Examiner rejected claims 1, 140 – 143, 147 – 148, 150, 156, 193, 194, 198 and 199 under 35 USC § 103(a) as being unpatentable over *Hamilton, et al.* (U.S. 5,901,037) in view of the China Reference (97212126.9). This rejection is respectfully traversed.

The Examiner stated that *Hamilton, et al.* discloses all of the Applicants' claim limitations, except for a high flow rate electroosmotic pump, which is taught by the China Reference. The Examiner concluded that it would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the cooling system of *Hamilton, et al.* with a high flow rate electroosmotic pump, wherein the pump is disposed between the heat exchanger and the substrate.

Hamilton, et al. teaches a closed-loop liquid cooling system having a non-mechanical magnetic pump for the liquid cooling. *Hamilton, et al.* also teaches that another pump that can be utilized comprises a miniature pump having an electrically driven diaphragm, such as a piezo-electric wafer, which when energized, produces a pumping action (col. 4, ll. 16 – 25). Further, at col. 4, ll. 62 – 67, *Hamilton, et al.* teaches that the miniature coolant pump includes a self-contained

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pyramidal input valve and output valve (i.e., check valves) located on the substrate and connected to input and output manifolds by conduits. *Hamilton, et al.* actually teaches away from the use of an electroosmotic pump.

The China Reference requires periodic venting of gases from gas collection chambers and shutting down of the pump while venting is occurring. Applicants' invention has no such limitation on venting of the gases generated in the pump during operation of the cooling system in a closed loop fluid flow.

The China Reference gave two examples of use of a porous core column electroosmotic pump. In the first example, which is depicted in Figure 1, the reference teaches a flow rate range of from 0.02 to 3.0 ml/min with a variation of flow rate of less than 0.5% and a continuing work time of at least four hours. The reference teaches that when the pump runs for a long time and the gas-liquid interface in the gas collection chamber (3) reaches a certain level, venting is needed. To vent, the power supply is turned off, the cover (10) is opened, water is added and the gas is vented. Thus, this first example is neither high flow rate nor does it permit venting or any other gas management during the operation of the pump. In the second example provided by the China Reference, the gas collection chambers (3) are glued to the sides of the pump body (7). Although the second example provides a greater flow rate range, it also has the limitation that venting must occur before each operation. Venting is accomplished by connecting tubes 9-1 and 9-2 to working fluid, closing valve 6-2, opening valve 10-2, opening valve 6-1, and closing valve 10-1, with all

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these steps occurring while no power is supplied to the pump. The power supply is then turned back on and electroosmotic flow is used to push out the gas in the gas chamber on the outlet side.

Claims 1 and 140 have been amended to recite that the high flow rate pump manages a plurality of generated gases. Support for this amendment to these claims is found on page 33, line 24 to page 35, line 13. However, the amendment of claim 1 is for the sole purpose of avoiding a double patenting rejection with claim 1 of the allowed parent application, serial number 10/053,859. The China Reference teaches away from management of gases during operation of the cooling system since gases are simply collected in the gas collection chamber. Therefore, claims 1 and 140 are allowable over the combination of *Hamilton, et al.* and the China Reference. Claims 141 – 143, 147, 148, 150 and 156 depend from claim 140 and are allowable for the same reason.

Claim 193 has been amended to recite the limitation added to claim 115, 164, 166 and 167 that the heat emitting device includes a plurality of regions of varying heat densities. The claim is also distinguished from *Hamilton, et al.* in that this reference does not teach a heat exchanger configured with at least one inlet and at least one outlet positioned on a side of the heat exchanger. For these reasons, claim 193 is patentable over the applied references. Claims 194, 198 and 199 depend from claim 193 and are allowable for the same reasons that claim 193 is allowable.

The Examiner rejected claims 144 – 146, 149, 151 – 153, 155, and 157 – 163 under 35 USC § 103(a) as being unpatentable over *Hamilton, et al.* (U.S. 5,901,037) in view of the China Reference (97212126.9) as applied to the claims above, and further in view of *Arana, et al.* (U.S. 2003/0027022). The rejection of these claims is respectfully traversed.

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Claims 144 – 146, 149, 151 – 153, 155, and 157 – 163 depend, either directly or indirectly, from amended claim 140. These claims are allowable for at least the same reasons that claim 140 is allowable.

Applicants acknowledge and appreciate the Examiner's finding of allowable subject matter in the claims 209 – 228. With regard to claims 139, 165, 169 – 171, 174 – 183, 190, 192, 195 – 197, and 200 – 208, the Examiner objected to these claims as being dependent upon a rejected base claim. Claims 139 and 165 have been canceled for the reasons set forth herein. The amendments made herein are such that no rewriting of the other objected to claims is necessary.

Applicants respectfully request that the Examiner enter this amendment after final rejection to afford Applicants the opportunity to respond to the new references cited in rejecting several of the claims. In view of the above, it is submitted that the rejections of the Examiner have been properly addressed and that the pending claims are in condition for allowance. Such action at an early date is earnestly solicited. It is also requested that the Examiner contact Applicants' attorney at the telephone number listed below should this response not be deemed to place this application in condition for allowance.

3/18/05
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